

THURSDAY, JUNE 30, 1910.

## A TREATISE ON ANTS.

*Ants: their Structure, Development, and Behaviour.*

By Prof. W. M. Wheeler. Pp. xxv+663. (New York: Columbia University Press; London: Macmillan and Co., Ltd., 1910.) Price 21s. net.

FROM the classic work of Huber to that of Forel our knowledge of ant life made comparatively little progress. Forel's remarkable researches, however, gave it a great impetus, and since then the students of this most fascinating department of natural history have been numerous and their discoveries most interesting.

Prof. Wheeler, who shows a most generous desire to do justice to other observers, and has himself contributed much to our knowledge, gives a bibliography which occupies no fewer than seventy pages of his work.

The most comprehensive contributions, he says, "have been made by Forel and Emery, but important work has been done by Adlerz, Ernest André, Bates, Belt, Bethe, Brauns, von Buttel-Reepen, Ebrard, Escherich, Goeldi, Heer, J. Huber, von Ihering, Janet, Karawaiew, Lameere, Lespès, Lubbock, Mayr, Moggridge, Reichenbach, Reuter, Rothney, Santschi, and Sykes."

Yet for many years there has been no comprehensive treatise on the subject. Prof. Wheeler, who promises us also a systematic monograph which will no doubt be most useful, has endeavoured, as he tells us,

to appeal to several classes of readers—to the general reader, who is always more or less interested in ants; to the zoologist, who cannot afford to ignore their polymorphism or their symbiotic and parasitic relationships; to the entomologist, who should study the ants if only for the purpose of modifying his views on the limits of genera and species; and to the comparative psychologist, who is sure to find in them the most intricate instincts and the closest approach to intelligence among invertebrate animals."

Chapter i. the author devotes to "Ants as Dominant Insects," discussing their interest for man, the probable causes of their dominance, the comparison of human and ant societies, the analogy between the ant colony and the cellular organism, the economic importance of ants, and their great interest as objects of biological study.

He then proceeds to their external structure—the segmentation of the body; the integument; the head, thorax, and abdomen. In the third chapter he deals with their internal structure—the alimentary tract; the glandular system; the reproductive organs and poison apparatus; the circulatory system and fat body; the respiratory, and, lastly, the muscular, system.

The fourth chapter is also devoted to the internal structure, and especially that of the nervous system and sense organs. In chapter v. he takes up their development—the care of the young; the egg, larva, pupa, and perfect insect; their length of life, and resistance to noxious influences. Chapter vi. deals with polymorphism, its extent and character; the

phylogenetic origin and development; Weismann's, Spencer's, and Emery's theories; the three aspects of the problem—physiological, ethological, and psychological; and the explanation of the development of the worker.

The same subject is continued in chapter vi., and especially the origin of the worker; the relation of instinct to polymorphism; the differentiation in function as the precursor of differentiation in structure.

Chapter viii. deals with the history of myrmecology and the classification of ants; ix. with their distribution; x. with fossil ants; xi. with habits; xii. and xiii. describe the various forms and structure of nests, their characteristics, the method of construction, &c.; xiv. deals with the Ponerine ants, which the author regards as unmistakably primitive, and the ancestors of the higher and more developed groups; xv. is devoted to the driver and legionary ants; xvi. to the harvesting ants; xvii. to the relations between ants and vascular plants; xviii. to the fungus-growing ants; xix. to the relations of ants to aphides, scale insects, tree hoppers, and caterpillars; xx. to honey ants; xxi. and xxii. to ant guests and parasites, especially beetles, flies, hymenoptera, diptera, mites, and nematodes.

Interesting as these chapters are, the next are even more so. They deal with the extraordinary relations existing between ants of different species; compound nests and mixed colonies; ant parasites; slave-making ants; degeneration as the result of dependence on others—a lesson, as he justly points out, to our statesmen and electors.

In chapter xxviii. the author comes to the sensations of ants, different types of behaviour, the senses as a basis for study, touch, smell and taste, hearing and vision.

The ocelli, which occur in the earliest known fossil insects, are supposed to give an indistinct visual image of very near objects, but, as he says, this view is not yet clearly established.

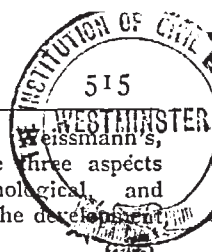
In chapters xxix. and xxx., Prof. Wheeler discusses the question of instinct, and concludes with five appendices, on (a) methods of collecting, mounting, and studying ants; (b) key to the subfamilies, genera, and subgenera of the North American Formicidæ, for the identification of the workers; (c) a list of described North American ants; (d) methods of exterminating noxious ants; (e) literature.

Any one of these chapters would afford ample materials for review, but this would involve too great a claim on the space at my disposal.

I will only say a few words on the concluding chapters, in which Prof. Wheeler deals with the instincts of ants (chapter xxix.) and their plastic behaviour (chapter xxx.).

He accepts the old scholastic distinction between "memory" and "recollection," one being used

"in the sense of having ideas of absent objects, rather than in the sense of behaving differently to present objects because of past experience with them. The dog shows clearly that he remembers his master in the latter sense by displaying joy at the sight of him. Can we be sure that he has remembered him in the



former sense during his absence; that is, that he has had a memory image of him?"

For my part, I cannot doubt this.

Prof. Wheeler attempts to explain away the evidence on which good naturalists—Leuckart, Rontanes, and others—have relied, and in several cases it seems to me that he does so satisfactorily. I do not myself regard the supposed case of ants dropping intentionally from ceilings on to food as definitely proved, but when Prof. Wheeler explains, or attempts to explain, it away by suggesting that "it may be a much more frequent method among ants of clearing vertical distances than has been supposed," one cannot but ask how it originated, and how it became so frequent.

The evidence, indeed, is contradictory, and difficult to reconcile. This applies not merely to the facts recorded by different observers. I have myself met with cases apparently showing intelligence, and others which seemed to imply the very reverse. Might not, however, the same be said in the case of man himself?

In conclusion, I may say that the illustrations are numerous—nearly 300—well chosen, and most of them good. Prof. Wheeler is much to be congratulated on having produced an excellent work, for which naturalists will, I am sure, be grateful.

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#### PRACTICAL METHODS FOR THE BIO-CHEMICAL LABORATORY.

*Handbuch der biochemischen Arbeitsmethoden.* By Prof. Emil Abderhalden. I., Erster Band, allgemeiner Teil, erste Hälfte. Pp. iv+512. Price 18 marks. II., Zweiter Band, spezieller Teil, erste Hälfte. Pp. iv+496. Price 18 marks. (Berlin and Vienna: Urban and Schwarzenburg, 1909.)

THESE two volumes form the first consignment of a comprehensive handbook of practical methods for the biochemical laboratory, which is being written by no fewer than sixty-four contributors under the guidance of Prof. Emil Abderhalden.

The second halves of each of the present volumes are promised shortly, and the third volume within the year. When it is remembered that the editor is also engaged upon research work in the laboratory, as well as his many contributors, and is, moreover, editing an equally colossal work now appearing, one can but wonder at the rapidity of German cooking of literature of this sort.

It is a pity that the articles are not published separately, as monographs for those specially interested in the individual subjects, for this would save purchasers buying a great deal of matter which they, in most cases, do not want in order to possess a much smaller part of value to them.

As it stands the work has no general interest, and while it may be serviceable in parts as a reference laboratory book, it will scarcely prove attractive or profitable for the private purchaser.

One wonders, in looking over the table of contents of the present and contemplated volumes, why the preference is made that it is issued in three volumes, since

by the simple device of making two halves of each of these divisions it comes to be in six volumes. It might equally well have been issued in one volume of six parts, each part forming a good sized volume; or in two volumes each of three parts; or in six volumes each of one part; or there might have been another and even better alternative.

The work can only be intended for the assistance of the research worker in a biochemical laboratory, and, looking at the matter from his point of view, it is surprising that the editor has allowed the first of the present volumes to appear in his work. All that is novel or interesting to the researcher in biochemistry of the five hundred pages it contains might readily, and with great gain in interest and utility, be compressed into fifty pages. As it stands it looks like nothing more than a glorified collection of catalogues of dealers in laboratory supplies; with the names of the dealers and prices of the commodities left out, much to its disadvantage. Scores of pages are sacrificed to drawings, photographs, and descriptions of apparatus with which we all have been familiar from our youth onwards in our everyday laboratory work. The first article in the volume dealing with this kind of thing occupies 282 pages; the new matter in it could easily be put into thirty pages. If the prices and makers' names were given, it might be of some service in the laboratory; as it is, to order any of the newer apparatus which suited any particular purpose, one would have to refer from the present work to the original paper by the inventor of the apparatus, where possibly the information might be obtained.

In striking contrast with this article of 282 pages is the one succeeding it, of less than seven pages, on the ultra-microscope, written by Fr. N. Schulz, of Jena. Knowing the valuable work of this author in the particular field in question, one expected something good here; but there is nothing new. It might almost be a reprint, as are the illustrations in it, of one of the advertisements of Carl Zeiss advertising the instruments.

There follow on this all too short article a number of lengthy ones on ultimate organic analysis, ash determinations, &c. Nearly all this matter has been written many times before, is contained in all practical works on organic chemistry, and is familiar to any but the merest tyro in biochemical work. For example, illustrations with descriptions of the combustion furnace and the combustion tube and its filling are given; eighteen pages are used up in descriptions of the Kjeldahl method for determining nitrogen, and illustrations are given of most of the modifications which perverted human ingenuity and waste of genius have given rise to for carrying out that somewhat simple method of analysis. Fourteen pages in a special article go to a description of specific-gravity methods—why not instead refer the reader to an elementary work on physics?

The second of the two volumes before us will be of more service to the biological chemist whose path is touched by the articles contained therein; these articles deal with the preparation, separation, and qualitative and quantitative estimation of the important lower and